Sediment Contaminant Study: Summary of Findings and Next Steps

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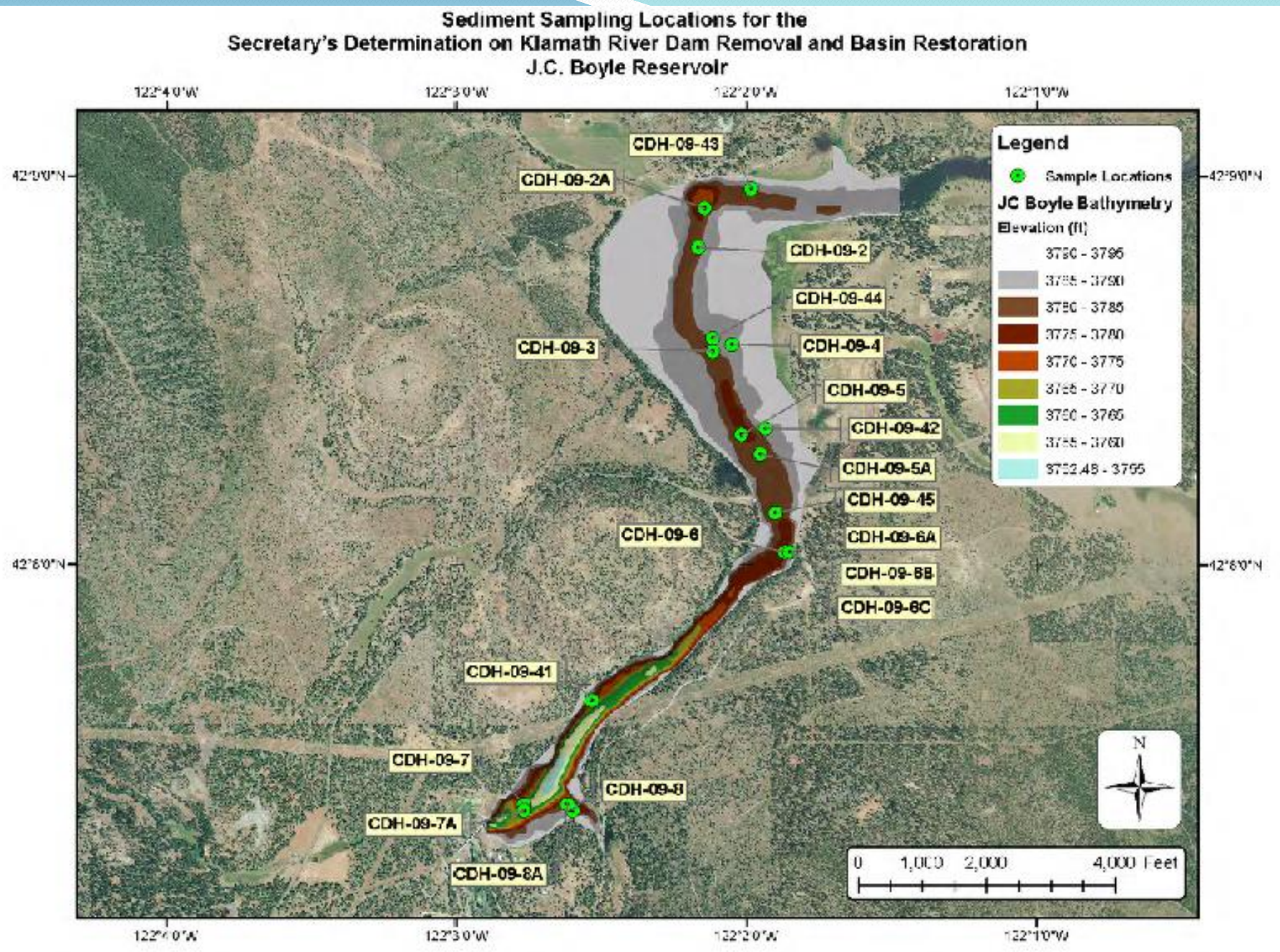
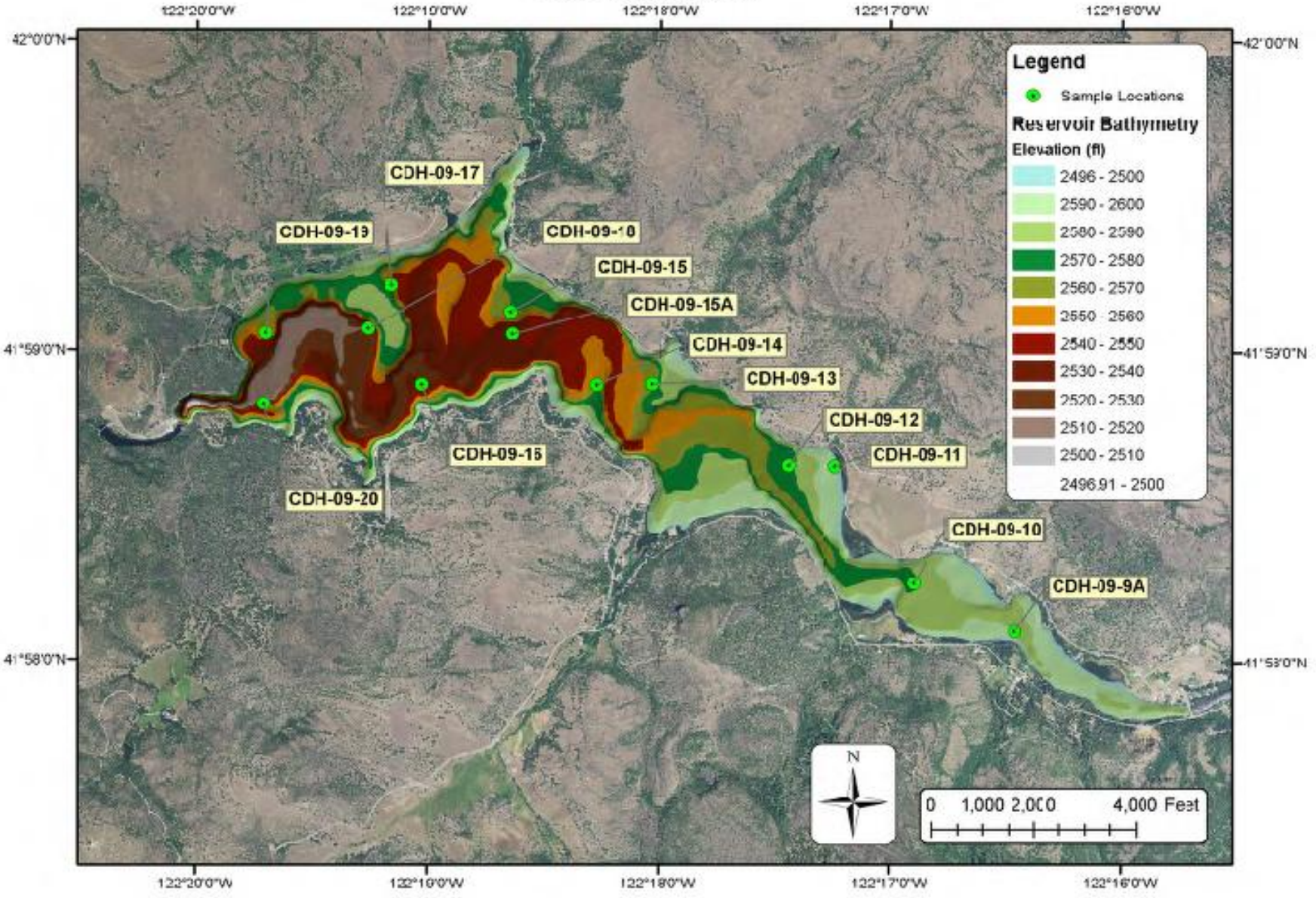
Outline

- Sampling Overview
- General Results (and interactive analysis, if desired)
- Comparisons with Screening Levels
- Bioassays
- Risk Evaluation
  - Fish Tissue Sampling

Overview of Sediment Contaminant Data

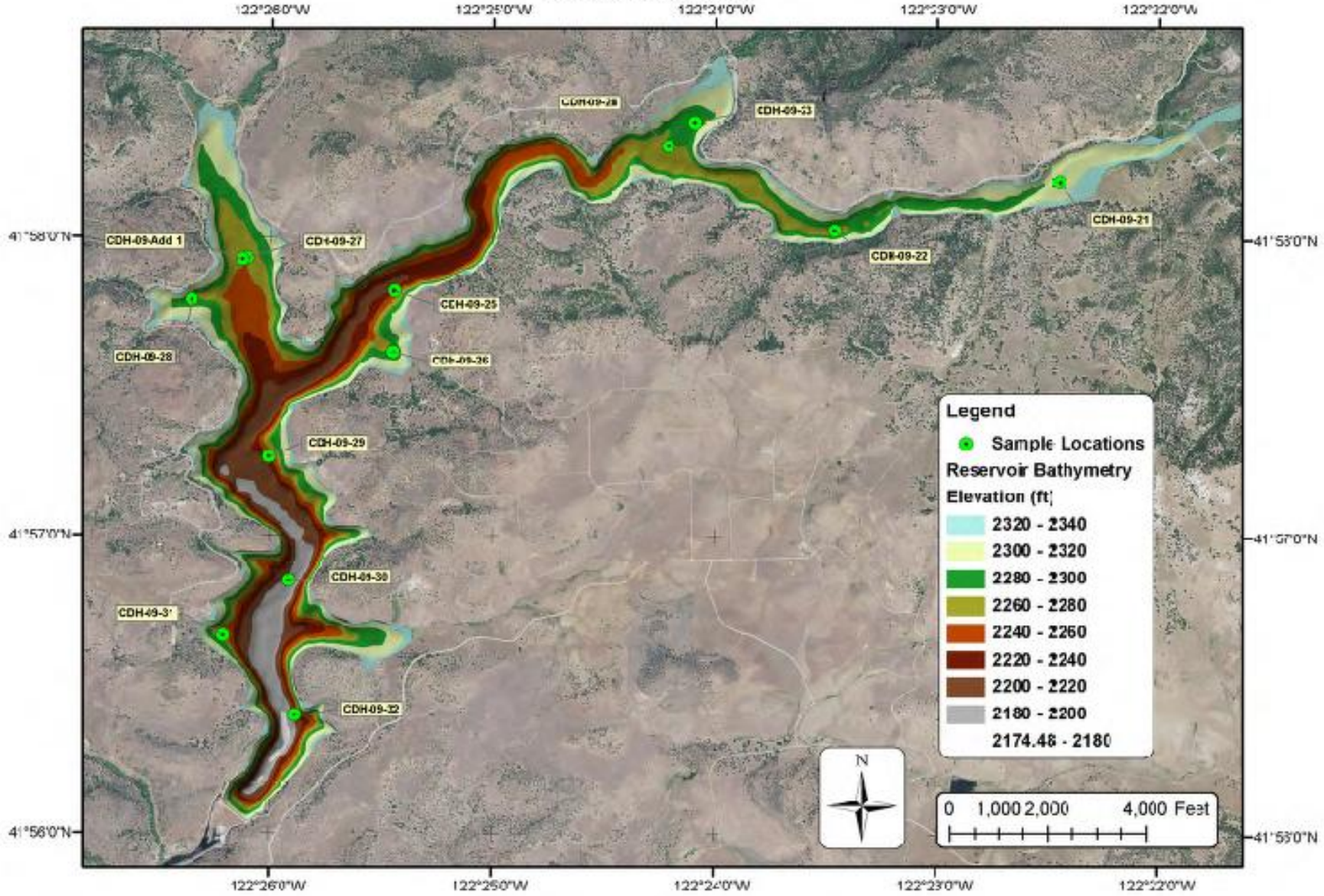
- Data, Press Release, Q&A, Maps, and QAPP are available at http://KlamathRestoration.gov
- Preliminary Findings:
  - Generally consistent with 2006 study results
  - Many commonly occurring chemicals detected, mostly at low levels
  - No indication of human health concern from direct contact with sediments, but a risk evaluation process is indicated
    - Some chemicals exceeded Tier 1 or Tier 2 screening levels
    - Some bioaccumulative chemicals detected [PCBs, Legacy OC Insecticides, Dioxins/Furans, Flame retardants (PBDEs)]
    - Some not-detected compounds had Reporting Limits higher than the relevant screening levels


Sediment Sampling Locations for the
Secretary's Determination on Klamath River Dam Removal and Basin Restoration
J.C. Boyle Reservoir
122°4'0"W
122°3'0"W
122°2'0"W
122°1'0"W
42°9'0"N
42°8'0"N
42°7'0"N
CDH-09-43
CDH-09-2A
CDH-09-2
CDH-09-44
CDH-09-3
CDH-09-4
CDH-09-5
CDH-09-42
CDH-09-5A
CDH-09-45
CDH-09-6
CDH-09-6A
CDH-09-6B
CDH-09-6C
CDH-09-41
CDH-09-7
CDH-09-8
CDH-09-7A
CDH-09-8A
Legend
Sample Locations
JC Boyle Bathymetry
Elevation (ft)
3790 - 3795
3785 - 3790
3780 - 3785
3775 - 3780
3770 - 3775
3765 - 3770
3760 - 3765
3755 - 3760
3752.48 - 3755
N
0 1,000 2,000 4,000 Feet


Sediment Sampling Locations for the
Secretary's Determination on Klamath River Dam Removal and Basin Restoration
Copco No. 1 Reservoir
122°20'0"W
122°19'0"W
122°18'0"W
122°17'0"W
122°16'0"W
42°0'0"N
42°00"N
41°59'0"N
41°58'0"N
CDH-09-17
CDH-09-19
CDH-09-18
CDH-09-15
CDH-09-15A
CDH-09-14
CDH-09-13
CDH-09-12
CDH-09-11
CDH-09-16
CDH-09-20
CDH-09-10
CDH-09-9A
Legend
Sample Locations
Reservoir Bathymetry
Elevation (ft)
2496 - 2500
2590 - 2600
2580 - 2590
2570 - 2580
2560 - 2570
2550 - 2560
2540 - 2550
2530 - 2540
2520 - 2530
2510 - 2520
2500 - 2510
2496.91 - 2500
N
0 1,000 2,000 4,000 Feet

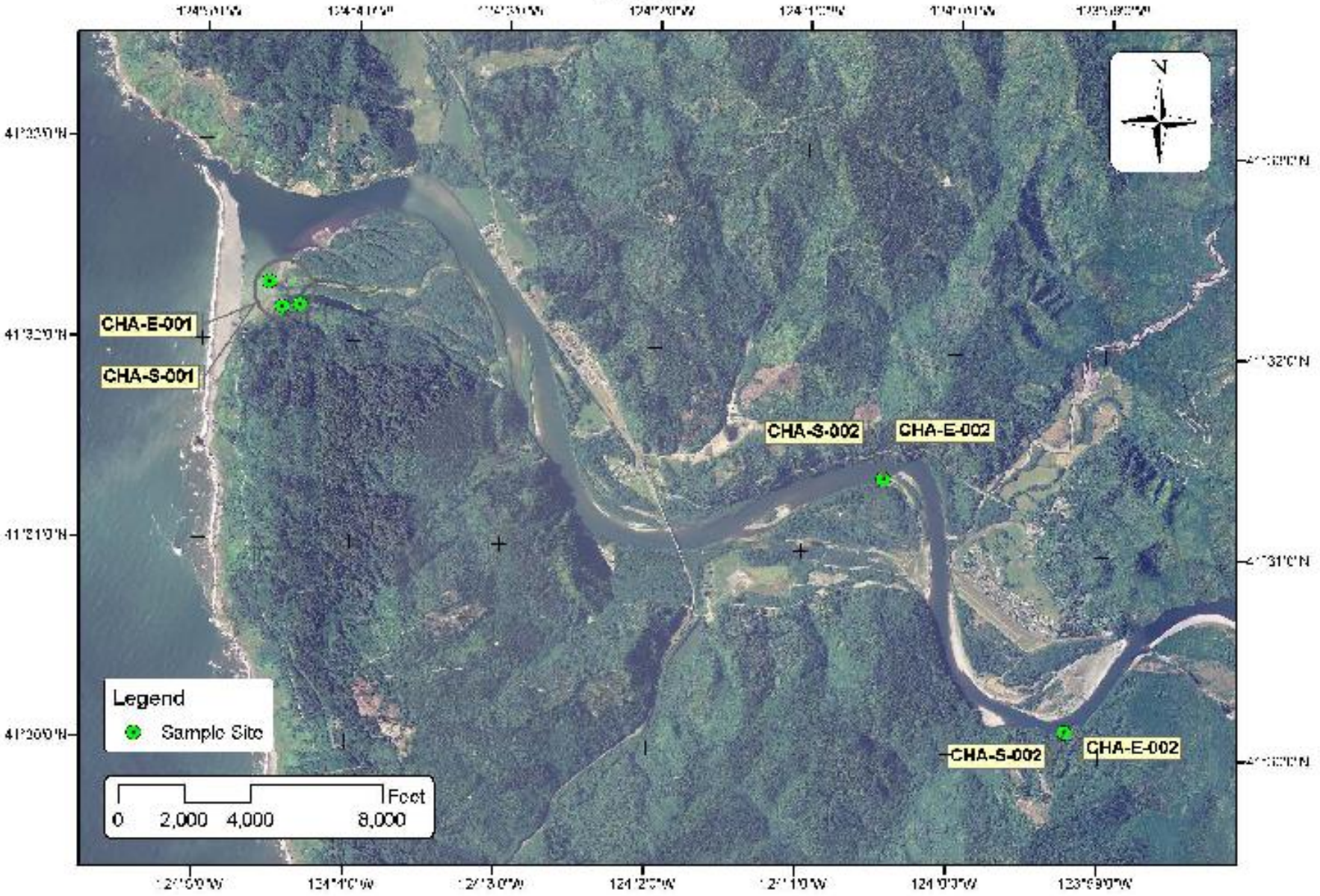
Sediment Sampling Locations for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration

Iron Gate Reservoir



Sediment Sampling Sites for the Klamath River Secretarial Determination and EIS/EIR

Estuary



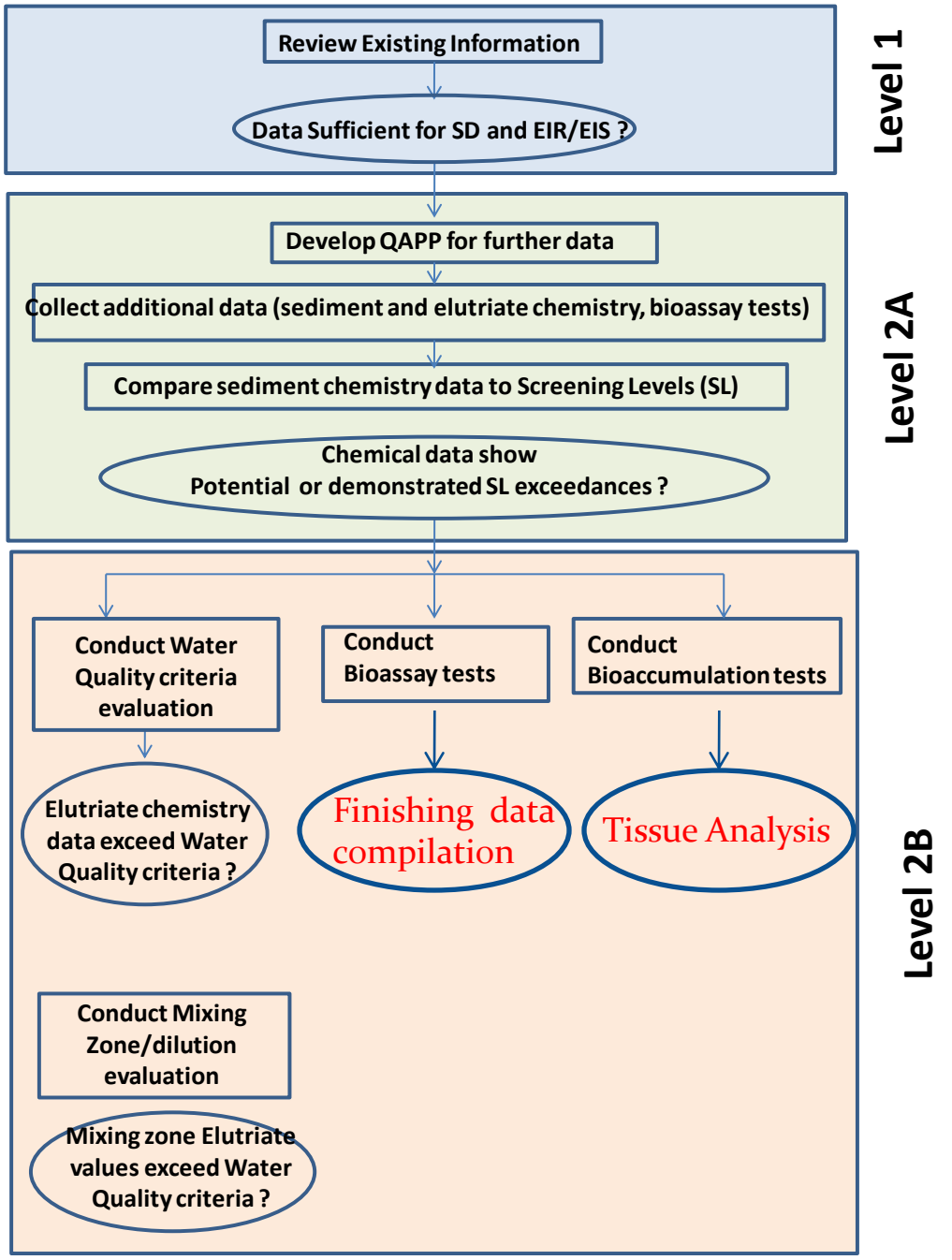
Sediment Evaluation Framework

- US Army Corps of Engineers Process for evaluating dredged materials
- Framework for sediment sampling, testing, and interpretation
  - Suitability of unconfined open water disposal
  - Potential risks of leaving sediments in-place.

1. Comparison of data to physical and chemical guidelines.
2. Biological testing of sediments
3. If bioaccumulative chemicals of concerns are present at levels of concern, a separate bioaccumulation assessment
   - Potential for contaminant accumulation in higher-level organisms.

Sediment Chemistry Evaluation Process

- Working with States of OR & CA because of issues of permitting and concurrence
- Informed by EPA's Inland Testing Manual and SEF
- Currently at equivalent of Level 2B in diagram
  - Bioassays are complete
  - Planning for bioaccumulation tests
- Risk Evaluation in EIS/EIR



Use of Screening Levels

- Help to identify when bottom dwelling organisms may be affected due to sediment chemical concentrations.
  - in place sediments
  - dredging (newly exposed sediment surface and unconfined open-water disposal sites).

- Draft evaluation done for sediment roll-out
- More thorough evaluation not quite complete yet

Preliminary Sediment Quality Screening Level Analysis

- Screening criteria used to evaluate data:
  - Puget Sound (DDA)/ Dredge Material Management Program (DMMP) values - Screening Level (SL), Bio-accumulation Trigger (BT) and Maximum Level (ML) Marine Guideline Chemistry Values
  - Sediment Evaluation Framework (SEF) for disposal of Dredged Material - Screening Level (SL, 1 and 2) values for both freshwater and marine water.
  - MacDonald et al, 2000 ERL and ERM values
  - Apparent Effects Threshold (AET) values – Low and High
- EPA Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites

JC Boyle Data Summary

JC BOYLE	Locations with positive detects	Compounds detected	Detected compounds exceeding guidelines (a)
VOCs	8 of 8 borings	Acetone 2-Butanone Diesel Range Organics	Acetone - 1 sample exceeded RSL
SVOCs	1 of 8 borings	Pentachlorophenol	None
Pesticides	2 of 8 borings	DDD/DDE/DDT Dieldrin Endrin Aldehyde HCH-delta Methoxychlor Permethrin Piperonyl Butoxide	Boring CDH-S-007 (Various depths) exceeded only the Marine ERM value (DDD/DDE/DDT; Dieldrin; Endrin Aldehyde; HCH-delta; Methoxychlor)
PCBs –	2	Total PCBs (sum) and congeners in Boring CDH-S-007 (0-18) and CDH-S-008 (0-1.7)	No total PCB values exceeded available guidelines
Dioxins / Furans	2	various	Addressed separately
PBDEs	2	various	N/A
Metals	8 of 8 borings	Aluminum Arsenic Chromium Copper Iron Lead Nickel Selenium Zinc	Chromium Copper Nickel Zinc

a – Criteria not available for all tested compounds

Copco 1 Data Summary

COPCO	Locations with positive detects	Compounds detected	Detected Compounds exceeding guidelines (a)
VOCs	12 of 12	Acetone 2-Butanone Diesel Range Organics Residual Range Organics	EPA RSL exceeded for some results for Acetone, Diesel Range Organics, and Residual Range Organics
SVOCs	0 of 12	none	N/A
Pesticides	7	Endrin Aldehyde HCH-beta HCH- delta Methoxychlor Piperonyl Butoxide	Marine ERLs exceeded in five borings (9,10, 16, 17 and 20) for: Endrin Aldehyde; HCH-beta; HCH-delta; Methoxychlor
PCBs –	2 of 12	Total PCBs and congeners	No total PCB values exceeded available guidelines
Dioxins / Furans	2 of 12	various	Addressed separately
PBDEs	2 of 12	Various	N/A
Metals	12	Aluminum Arsenic Chromium Copper Iron Lead Nickel Selenium Zinc	Chromium Copper Iron Nickel Zinc
a – Criteria not available for all tested compounds			

Iron Gate Data Summary

IRON GATE	Locations with positive detects	Compounds detected	Detected compounds exceeding guidelines (a)
VOCs	13 of 13	Acetone 2-Butanone Diesel Range Organics Residual Range Organics	none
SVOCs	0 of 13	none	N/A
Pesticides	3 of 13	Endosulfan II Chlorpyrifos Permethrin (Total) Piperonyl Butoxide	none
PCBs –	3 of 13	Total PCBs (sum) and congeners	No total PCB values exceeded available guidelines
Dioxins / Furans	3 of 13	various	Addressed separately
PBDEs	2 of 13	Various in 2 borings	N/A
Metals	13 of 13	Aluminum Arsenic Chromium Copper Iron Lead Nickel Selenium Zinc	Arsenic Copper Nickel

a – Criteria not available for all tested compounds

Estuary Data Summary

ESTUARY	Locations with positive detects	Compounds detected	Compounds exceeding criteria (a)
VOCs	2 of 2	Acetone Diesel Range Organics	none
SVOCs	0 of 2	None	N/A
Pesticides	1 of 2	HCH- delta Methoxychlor Piperonyl Butoxide	Methoxychlor in 1 sample
PCBs	2 of 2	Total PCBs (sum) and congeners	No total PCB values exceeded available guidelines
Dioxins / Furans			Addressed separately
PBDEs			N/A
Metals	2 of 2	Aluminum Arsenic Chromium Copper Iron Lead Nickel Selenium Zinc	Chromium Copper Iron Zinc
a – Criteria not available for all tested compounds			

Summary of TEQs, 2009-2010.

Dioxin

		TEQ (parts per trillion)		
Location	Site_Code	Humans & Mammals	Fish	Avian Species
JC Boyle Reservoir	CDH-S-007	7.09	5.04	6.23
JC Boyle Reservoir	CDH-S-008	6.17	4.28	5.51
Copco1 Reservoir	CDH-S-014	8.04	5.83	7.51
Copco1 Reservoir	CDH-S-015A	7.93	5.86	7.16
Iron Gate Reservoir	CDH-S-029	3.05	2.10	3.16
Iron Gate Reservoir	CDH-S-031	3.08	2.29	2.76
Iron Gate Reservoir	CDH-S-046	3.11	2.21	2.98
Lower Klamath Estuary	CHA-S-001	0.11	0.10	0.15
Upper Klamath Estuary	CHA-S-002	0.06	0.06	0.08

Screening Level Comparisons – PAH's & Semivolatiles

- Mostly non-detections at reporting levels above the Screening Levels
  - Reduces ability to evaluate screening level compliance
  - Currently in discussions with laboratory about possible remedies
  - Gathard data from 2006 provide another data set for comparison with screening levels.
    - Only 2 compounds reported as exceeding PSDDA screening levels (ethylbenzene, total xylenes)
    - Currently in process to confirm the 2006 findings against SL's used in Secretarial Determination

Sediment Chemistry Evaluation Process

- Working with States of OR & CA because of issues of permitting and concurrence
- Informed by EPA's Inland Testing Manual and SEF
- Currently at equivalent of Level 2B in diagram
  - Bioassays are complete
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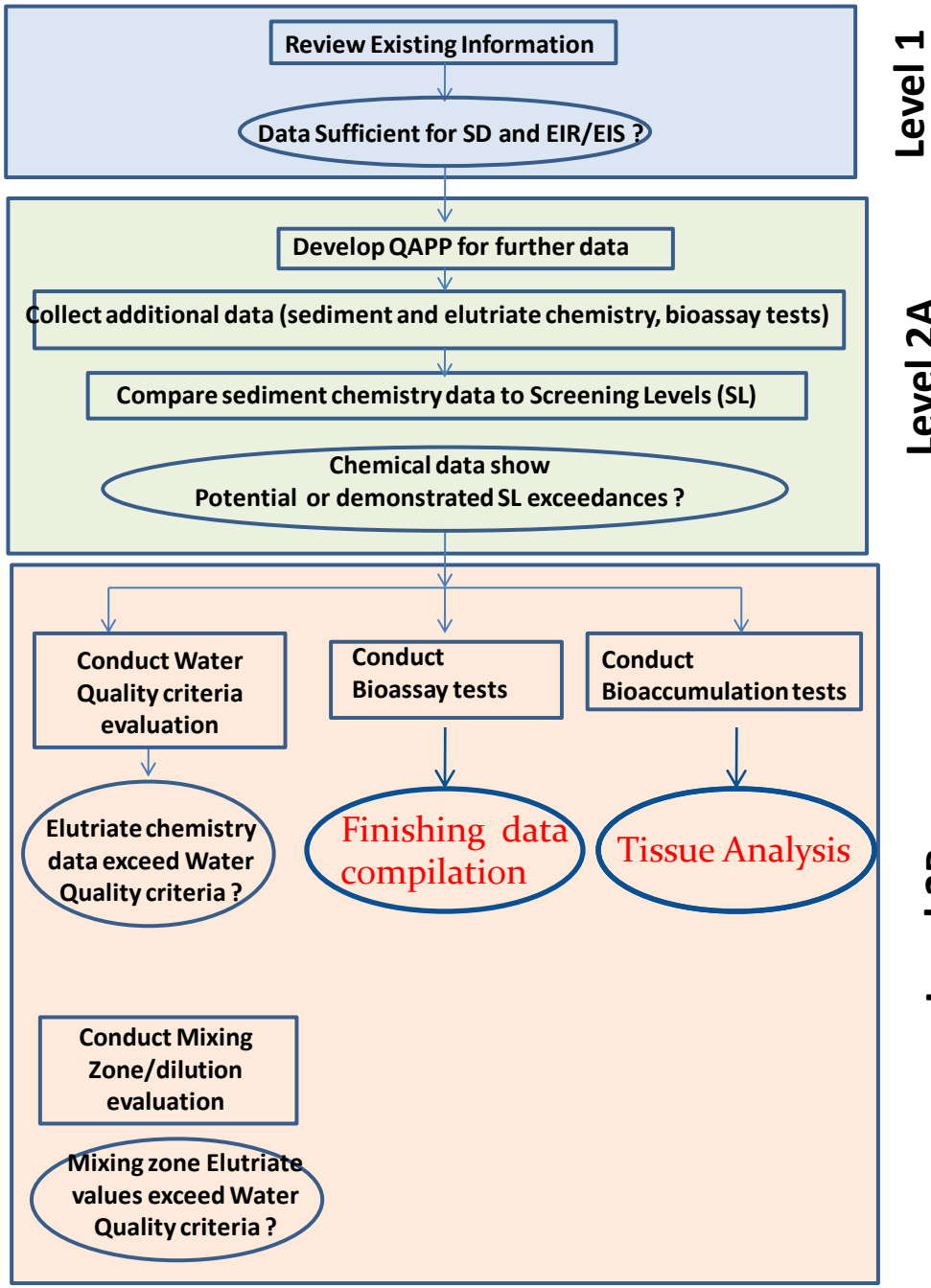
- Risk Evaluation in EIS/EIR



Bioassessment Tests

- Provide information about different possible adverse biological effects in the environment.
- Testing using multiple species reduces uncertainty about the results and limits errors in interpretation of these tests
- Expose representative aquatic/bottom dwelling species to appropriate test media
  - lethal and sublethal effects

✓ Short term (4-day) test of exposure to elutriates (water extracted from a sediment – water mixture) using fish

✓ Longer term (10 day) test of direct toxicity to sediments using aquatic invertebrates

⇒ Bioaccumulation tests for specific chemicals in invertebrates, and bivalves exposed to sediments.

⇒ Bioaccumulation tests in fish for human health considerations

Sediment Bioassay

- Acute Toxicity Test for Aquatic Invertebrates
  - Standard EPA Procedure to test direct toxicity of sediment to invertebrates during dredging
  - Test organisms were a midge (*Chironomus dilutus)* and an amphipod *(Hyalella azteca)*
  - 10-day direct exposure of invertebrates to sediment and controls
  - 8 – Replicates, 10 organisms in each replicate

Elutriate Bioassay Test

- Acute Toxicity Test for Fish
  - 4-day (96 hr) exposure to elutriates
    - Controls, Surface water from reservoirs, and serial dilutions with elutriate (1%, 10%, 50%, 100%)
  - Tests toxicity of sediment-water mixture to aquatic biota during dredging
  - Test organism was rainbow trout
  - 5-replicates, 10 fish each in each replicate
  - Generates estimates of a sediment $LC_{50,}$ or the percent of a sediment-water mixture at which 50% of a population of the test organisms would be killed.

Bioaccumulation Assays

- Initial exposures are done but analytical tests were withheld until sediment chemistry analysis was done, to focus analysis on most important compounds
- Currently in contracting for a laboratory to do the analyses
- Will test bioaccumulative compounds
  - Dioxins / Furans, PCBs, Legacy organochlorine insecticides
  - Mercury (Hg), Algal toxins, Flame Retardants (PBDEs)

Why sample fish? Why now?

- From the sediment data release, we heard a lot of concern about consumption of reservoir fish
- Fish tissue analysis and human health risks are an important concern
- Most applicable to No-Action alternative, and may provide helpful information for the Action alternative.

Fish Tissue Collection – Objective

- **Evaluate potential human health risks from bioaccumulatory contaminants associated with consuming resident fish the reservoirs**

Fish Tissue Data Collection

- Provides information needed for step 3 in Risk Evaluation process (& Level 2B in Inland Testing Manual diagram)
- Currently in design process, with input from States and EPA
- Field sample just completed (September 27-October 1)
- In contracting for laboratory analyses

Fish Sampling Approach

- Collected from JC Boyle, Copco and Iron Gate Resevoirs from Sept 27-30th, 2010.
  - - Bullhead
  - - Rainbow Trout
  - - Large Mouth Bass
  - - Perch
  - - Crappie

- Will be analyzed for bioaccumulative chemicals of concern: dioxins/furans, PCB congeners, PDBE congeners, and organochlorine pesticides.

Data decisions to support objective

- Fish species?
  - May need multiple species
    - Top level predator, for human risks (e.g. bass or perch)
- Fish tissue type?
  - Most likely whole body rather than filets
- Number of fish?
  - Need enough to support decisions, based on variability of results
  - Consideration of composites to meet goals and increase "n"

Risk Evaluation & Next Steps

1. Verify rapid screening assessment (i.e. Level 2A from Inland Testing Manual diagram
2. Develop conceptual model for exposure pathways under the project alternatives
3. Develop information and evaluation tools for exposure pathways from step 2
4. Conduct risk evaluations using existing models (part of EIS process).

Questions?